What is claimed is:

1.   A visual inspection method comprising:

taking a photograph of an illuminated inspection target sample from above to generate an original picture;

5   converting said original picture obtained by said taking into a binary picture;

labeling said binary picture obtained by said converting to generate a labeling picture;

forming a circumscribing rectangle

10 circumscribing an outer circumference of said labeling picture obtained by said labeling;

inverting said labeling picture circumscribed by said circumscribing rectangle formed by said forming to generate a inversion

15 picture;

removing a picture in a region surrounded by said outer circumference of said labeling picture and said circumscribing rectangle from said inversion picture obtained by said inverting

20 to generate a removal picture;

adding said removal picture obtained by said removing to said labeling picture to generate an inspection picture; and

judging a pass or rejection of said

25 inspection target sample based on said inspection picture obtained by said adding.

2.   The visual inspection method according to claim 1, wherein said judging is performed based on at least one of an area of said inspection picture, a diameter of said inspection picture and a circulation degree defined by a ratio of said area to another area calculated by a predetermined equation.

3.   The visual inspection method according to claim 2, further comprising:

generating a new inspection picture by converting pixels around a plurality of pixels forming an outer circumference of said inspection picture into sub-pixels,

wherein said judging is performed based on said new inspection picture obtained by said generating.

4.   A visual inspection method comprising:

taking a photograph of an illuminated inspection target sample from above to generate an original picture;

converting said original picture obtained by said taking into a binary picture;

labeling said binary picture obtained by said converting to generate a labeling picture;

calculating a summation of shade values of

10 said original picture corresponding to said

labeling picture generated by said labeling; and

judging a pass or rejection of said

inspection target sample based on said summation

of the shade values obtained by said calculating.

5. The visual inspection method according to

claim 4, further comprising:

generating a new labeling picture by

converting pixels around a plurality of pixels

5 forming an outer circumference of said labeling

picture generated by said labeling into sub-

pixels,

wherein said calculating is performed by

calculating a summation of shade values of said

10 original picture corresponding to said new

labeling picture obtained by said generating.

6. The visual inspection method according to

claim 4, further comprising:

calculating an area of said labeling

picture; and

5 calculating an average shade value of said

original picture corresponding to said labeling

picture by dividing said summation of said shade

values of said original picture by said

calculated area,

10   wherein said judging is performed by
judging said pass or rejection of said inspection
target sample based on said calculated average
shade value.

7.   The visual inspection method according to
claim 6, further comprising:
        calculating a total average shade value by
averaging all of said calculated average shade
5 values,
        wherein said judging is performed by
judging said pass or rejection of said inspection
target sample based on said calculated total
average shade value.

8.   The visual inspection method according to
claim 7, wherein said judging of said pass or
rejection of said inspection target sample is
performed based on a difference between said
5 calculated average shade value and said
calculated total average shade value, or a rate
of said calculated average shade value to said
calculated total average shade value.

9.   A visual inspection method comprising:
        taking a photograph of an illuminated
inspection target sample from above to generate

an original picture;

5   converting said original picture obtained
by said taking into a binary picture;

labeling said binary picture obtained by
said converting to generate a labeling picture;

calculating a distance between every two
10 pixels of a plurality of pixels forming an outer
circumference of said labeling picture over all
combinations of two pixels of said plurality of
pixels;

determining a longest distance of a
15 plurality of said distances obtained by said
calculating; and

judging a pass or rejection of said
inspection target sample based on said determined
longest distance.

10.   The visual inspection method according to
claim 9, wherein said determining step
comprising:

generating a first sub-pixel picture by
5   converting pixels around one of two pixels
forming said longest distance into sub-pixels and
generating a second sub-pixel picture by
converting pixels around another one of the two
pixels forming said longest distance into sub-
10 pixels;

calculating a sub-pixel distance between
every sub-pixels of a plurality of sub-pixels
forming an outer circumference of said labeling
picture formed by said first sub-pixel picture

15 and every sub-pixels of a plurality of sub-pixels
forming an outer circumference of said labeling
picture formed by said second sub-pixel picture
overall combinations of a plurality of sub-pixels
forming said outer circumference of said labeling

20 picture formed by said first sub-pixel picture
and a plurality of sub-pixels forming said outer
circumference of said labeling picture formed by
said second sub-pixel picture; and

determining a longest distance of a

25 plurality of said calculated sub-pixel distances,
wherein said judging of said pass or
rejection of said inspection target sample is
performed based on said determined longest
distance of said plurality of said sub-pixel

30 distances.

11. The visual inspection method according to
claim 10, wherein said generating step further
comprising:

generating a sub-pixel picture by

5 converting pixels around one of two pixels
forming a distance in a predetermined range from

said longest distance into sub-pixels to add to

said first sub-pixel; and   generating a sub-

pixel picture by converting pixels around another

10   one of said two pixels forming the distance in a

predetermined range from said longest distance

into sub-pixels to add to said second sub-pixel.

12.   The visual inspection method according to

claim 9, further comprising:

generating a center or a center of gravity

of said labeling picture,

5   wherein said calculating is performed by

calculating a distance between a pixel forming an

outer circumference of said labeling picture and

being located at a farthest distance from said

center or said center of gravity calculated and

10   another pixel forming said outer circumference of

said labeling picture over all combinations of

said one pixel and said other pixel of said

plurality of pixels forming said outer

circumference of said labeling picture.

13.   The visual inspection method according to

claim 9, further comprising:

converting pixels forming said labeling

picture into sub-pixels,

5   wherein said calculating is performed by

calculating a distance between every two sub-pixels of a plurality of sub-pixels forming an outer circumference of said labeling picture converted into said sub-pixels over all

10 combinations of two sub-pixels of said plurality of sub-pixels.

14.   The visual inspection method according to claim 3, wherein said original picture obtained by said taking is a picture of a Ball Grid Array (BGA).

15.   A visual inspection apparatus comprising:
        a camera which takes a photograph of an inspection target sample illuminated with an illuminator from above to output an original

5   picture;
        a binary conversion unit which converts said original picture outputted from said camera into a binary picture;
        a labeling unit which labels said binary

10 picture outputted from said binary conversion unit to generate a labeling picture;
        a circumscribing rectangle forming unit which forms a circumscribing rectangle circumscribing an outer circumference of said

15 labeling picture generated by said labeling unit;

an inspection picture generating unit which
generates an inspection picture based on said
labeling picture surrounded by said
circumscribing rectangle formed by said
20   circumscribing rectangle forming unit; and

a judging unit which judges a pass or
rejection of said inspection target sample based
on said inspection picture generated by said
inspection picture generating unit,

25   wherein said inspection picture generating
unit comprising:

an inverting unit which inverts said
labeling picture circumscribed by said
circumscribing rectangle formed by said
30   circumscribing rectangle forming unit to generate
a inversion picture;

a removing unit which removes a picture in
a region surrounded by said outer circumference
and said circumscribing rectangle from said
35   inversion picture generated by said inverting
unit to generate a removal picture; and

an adding unit which adds said removal
picture generated by said removing unit to said
labeling picture to generate said inspection
40   picture.

16.   The visual inspection apparatus according

to claim 15, wherein said judging unit judges

said pass or rejection based on at least one of

an area of said inspection picture generated by

5 said inspection picture generating unit, a

diameter of said inspection picture and a

circulation degree defined by a ratio of said

area to another area calculated by a

predetermined equation.

17.   The visual inspection apparatus according

to claim 16, further comprising:

a sub-pixel generating unit which converts

pixels around a plurality of pixels forming an

5 outer circumference of said inspection picture

generated by said inspection picture generating

unit into sub-pixels to generate a new inspection

picture,

wherein said judging unit judges said pass

10 or rejection of said inspection target sample

based on said new inspection picture generated by

said sub-pixel generating unit.

18.   A visual inspection apparatus comprising:

a camera which takes a photograph of an

inspection target sample illuminated with an

illuminator from above to output an original

5 picture;

a binary conversion unit which converts said original picture outputted from said camera into a binary picture;

a labeling unit which labels said binary

10   picture outputted from said binary conversion unit to generate a labeling picture;

a shade value summation calculation unit which calculates a summation of shade values of said original picture corresponding to said

15   labeling picture generated by said labeling unit; and

a judging unit which judges a pass or rejection of said inspection target sample based on said summation of the shade values calculated

20   by said shade value summation calculation unit.

19.   The visual inspection apparatus according to claim 18, further comprising:

a sub-pixel generating unit which converts pixels around a plurality of pixels forming an

5   outer circumference of said labeling picture generated by said labeling unit into sub-pixels to generate a new labeling picture,

wherein said shade value summation calculation unit calculates a summation of shade

10   values of said original picture corresponding to said new labeling picture generated by said sub-

pixel generating unit.

20.   The visual inspection apparatus according
to claim 18, further comprising:

an area calculation unit which calculates
an area of said labeling picture; and

5   an average shade value calculation unit
which calculates an average shade value of said
original picture corresponding to said labeling
picture by dividing said summation of the shade
values of said original picture calculated by

10   said shade value summation calculation unit by
said area calculated by said area calculation
unit,

wherein said judging unit judges said pass
or rejection of said inspection target sample

15   based on said average shade value calculated by
said average shade value calculation unit.

21.   The visual inspection apparatus according
to claim 20, further comprising:

a total average shade value calculation
unit which calculates a total average shade value

5   by averaging all of said average shade values
calculated by said average shade value
calculation unit,

wherein said judging unit judges said pass

or rejection of said inspection target sample

10   based on said total average shade value

calculated by said total average shade value

calculation unit.

22.   The visual inspection apparatus according

to claim 21, wherein said judging unit judges

said pass or rejection of said inspection target

sample, based on a difference between said

5   average shade value calculated by said average

shade value calculation unit and said total

average shade value calculated by said total

average shade value calculation unit, or a rate

of said average shade value calculated by said

10   average shade value calculation unit to said

total average shade value calculated by said

total average shade value calculation unit.

23.   A visual inspection apparatus comprising:

a camera which takes a photograph of an

inspection target sample illuminated with an

illuminator from above to output an original

5   picture;

a binary conversion unit which converts

said original picture outputted from said camera

into a binary picture;

a labeling unit which labels said binary

10 picture outputted from said binary conversion

unit to generate a labeling picture;

a distance calculation unit which

calculates a distance between every two pixels of

a plurality of pixels forming an outer

15 circumference of said labeling picture generated

by said labeling unit over all combinations of

two pixels of said plurality of pixels;

a longest distance calculation unit which

determines a longest distance of a plurality of

20 said distances calculated by said distance

calculation unit; and

a judging unit which judges a pass or

rejection of said inspection target sample based

on said longest distance determined by said

25 longest distance calculation unit.

24.   The visual inspection apparatus according

to claim 23, further comprising:

a sub-pixel generating unit which generates

a first sub-pixel picture by converting pixels

5 around one of two pixels forming said longest

distance into sub-pixels and generates a second

sub-pixel picture by converting pixels around

another one of the two pixels forming said

longest distance into sub-pixels;

10   a sub-pixel distance calculation unit which

calculates a distance between every sub-pixels of

a plurality of sub-pixels forming an outer

circumference of said labeling picture formed by

said first sub-pixel picture generated by said

15   sub-pixel generating unit and every sub-pixels of

a plurality of sub-pixels forming an outer

circumference of said labeling picture formed by

said second sub-pixel picture generated by said

sub-pixel generating unit overall combinations of

20   a plurality of sub-pixels forming said outer

circumference of said labeling picture formed by

said first sub-pixel picture and a plurality of

sub-pixels forming said outer circumference of

said labeling picture formed by said second sub-

25   pixel picture; and

        a sub-pixel longest distance calculation

unit which determines a longest distance of a

plurality of said distances calculated by said

sub-pixel distance calculation unit,

30   wherein said judging unit judges said pass

or rejection of said inspection target sample

based on said longest distance determined by said

sub-pixel longest distance calculation unit.

25.   The visual inspection apparatus according

to claim 24, wherein said sub-pixel generating

unit further converts pixels around one of two

pixels forming a distance in a predetermined

5   range from said longest distance into sub-pixels

to add to said first sub-pixel picture and

converts pixels around another one of said two

pixels forming the distance in a predetermined

range from said longest distance into sub-pixels

10   to add to said second sub-pixel picture.

26.   The visual inspection apparatus according

to claim 23, further comprising:

     a center calculation unit which calculates

a center or a center of gravity of said labeling

5   picture,

     wherein said distance calculation unit

calculates a distance between a pixel forming an

outer circumference of said labeling picture and

being located at a farthest distance from said

10   center or said center of gravity calculated by

said center calculation unit and another pixel

forming said outer circumference of said labeling

picture over all combinations of said one pixel

and said other pixel of said plurality of pixels

15   forming said outer circumference of said labeling

picture.

27.   The visual inspection apparatus according

to claim 23, further comprising:

a sub-pixel conversion unit which converts pixels forming said labeling picture into sub-
5   pixel,

wherein said distance calculation unit calculates a distance between every two sub-pixels of a plurality of sub-pixels forming an outer circumference of said labeling picture
10   converted into said sub-pixels by said sub-pixel conversion unit over all combinations of two sub-pixels of said plurality of sub-pixels.

28.   The visual inspection apparatus according to claims 17, wherein said original picture obtained by said camera is a picture of a Ball Grid Array (BGA).